Aerodynamic and articulatory aspects of French nasal vowels.

Didier Demolin, Bernard Teston

RSITÉ DE PROVENCE

TRAVAUX DE L'INSTITUT DE PHONÉTIQUE D'AIX

Laboratoire Parole et Langage
ESA 6057 CNRS

VOLUME 18 - 1998

Travaux de l'Institut de Phonétique d'Aix

Volume 18, 1997-1998, pp. 47-59

ASPECTS AERODYNAMIQUES ET ARTICULATOIRES DES VOYELLES NASALES DU FRANÇAIS

Demolin Didier
Teston Bernard

ASPECTS AERODYNAMIQUES ET ARTICULATOIRE DES VOYELLES NASALES DU FRANÇAIS

Résumé

Les études phonétiques sur les voyelles nasales du Français ont été menées dans le passé tant du point de vue acoustique (Maeda 1993) qu'articulatoire (Zerling 1984). Parallèlement, plusieurs approches phonologiques de la nasalité du Français ont été proposées (Walter 1977 et Durand 1988). Notre propos et d'intégrer des analyses phonétiques menées au moyen de techniques d'investigation modernes dans un contexte de phonologie articulatoire. L'étude porte sur les données aérodynamiques et articulatoires (RMN) d'un corpus de voyelles nasales parlé en Belgique et dans le sud de la France (Marseille). L'étude aérodynamique montre une différence fondamentale entre les quatre voyelles nasales [ɛ̃, œ̃, ɑ̃ ɔ̃] prononcées par les deux groupes de locuteurs. Dans le parler du nord, le débit d'air nasal commence aussitôt que la fermeture ou la constriction de la consonne précédente se relâche. Cela n'est pas le cas pour le parler du sud dans lequel le débit d'air nasal commence seulement dans la seconde partie ou à la fin de la voyelle. Ceci semble correspondre à l'appendice vélaire mentionné par Walter (1977) et Carton et al (1983).Du point de vue articulatoire, l'imagerie par résonance magnétique nucléaire dynamique montre que dans le dialecte du nord, le voile est abaissé durant toute la durée de la voyelle. Cela n'est pas le cas dans le dialecte du sud ou il existe un contact vélaire à la fin de chaque voyelle. Nous proposons une représentation phonologique gestuelle des voyelles nasales et de la nasalité.

ARTICULATORY AND AERODYNAMIC ASPECTS OF NASAL VOWELS IN FRENCH

Abstract

The phonetics of French nasal vowels has received a lot of attention in the past, both from an acoustical point of view (e.g. Maeda 1993) and from an articulatory point of view (e.g. Zerling 1984). In addition many phonological treatments of nasality and nasal vowels have been proposed for French (e.g. Walter 1977 and Durand 1988). Data come from a description of aerodynamic and articulatory aspects of French nasal vowels, spoken in Belgium and in the South of France (Marseille). Aerodynamic results show that there is a fundamental difference between the four nasal vowels [ɛ̃, œ̃, ɑ̃ , ɔ̃] in the two groups of speakers. In the northern dialect, nasal flow starts as soon as the closure or the constriction of a preceding consonant is released. This is not the case in the southern dialect where nasal flow starts only in the second part or at the end of the vowels. This seems to correspond to the velar appendix which was mentioned by Walter (1977) and by Carton et al. (1983). From the articulatory point of view, dynamic magnetic resonance shows that in the northern dialect, the velum is lowered during the entire vowel but in the southern dialect there is a contact in the velar region at the end of all vowels.

1. Aerodynamic data

1.1. Method

A simultaneous recording of intraoral pressure, oral and nasal airflows was made with two speakers of each dialect. Recordings were made at the phonology laboratory of the University of Brussels and at the phonetics laboratory in Aix-en-Provence. A small fexible plastic tube (ID 2mm) was inserted through the nasal cavity to the oropharynx, for the measurement of intraoral pressure.

Oral airflow was measured with a flexible silicone rubber mouthpiece. Nasal airflow was measured through an olive inserted in one nostril. The olive was connected to a 0.5 cm plastic tube. The tubes and rubber mouthpiece were connected to a Physiologia workstation (Teston and Galindo 1990, 1995) consisting in a PC computer and an acquisition system equipped with various transducers and the signal editing and processing software Phonedit. The subject task was to pronounce and repeat 3 time each sentence of the corpus presented in table 1. Phonations were produced with a normal voice quality at a normal speech rate. There were no special instructions for the speaker to control the pitch of the phonations.

1.2. Results

The comparison of aerodynamic data obtained with one speaker of each dialect shows that the behaviour of both group of speakers is quite different. Figure 1 and 2 show acoustic (audio-signal, spectrogram) and aerodynamic (nasal and oral airflow) recordings of the sentence « un bon vin blanc » [œ̃ b ɔ̃ v ɛ̃ b l ɑ̃] produced by one speaker of each dialect.

Speaker 1 (Northern dialect) clearly nasalizes the vowels but the vowel [ɛ̃] for which there is an observable nasal flow only at the end of the vowel. This flow continues and reaches a peak during the production of the next segment which is the bilabilal stop [b], suggesting that there is some assimilation of the nasal vowel with the following stop. This phenomenon is also observed between the fisrt vowel [œ̃] and the next consonant.

The nasal flow plot of speaker 2 from the Southern dialect (Figure 2) shows that, all vowel are mainly oral but for the first vowel where there is quickly some observable nasal flow. As can be seen nasal flow is observed only at the end or after the vowel.

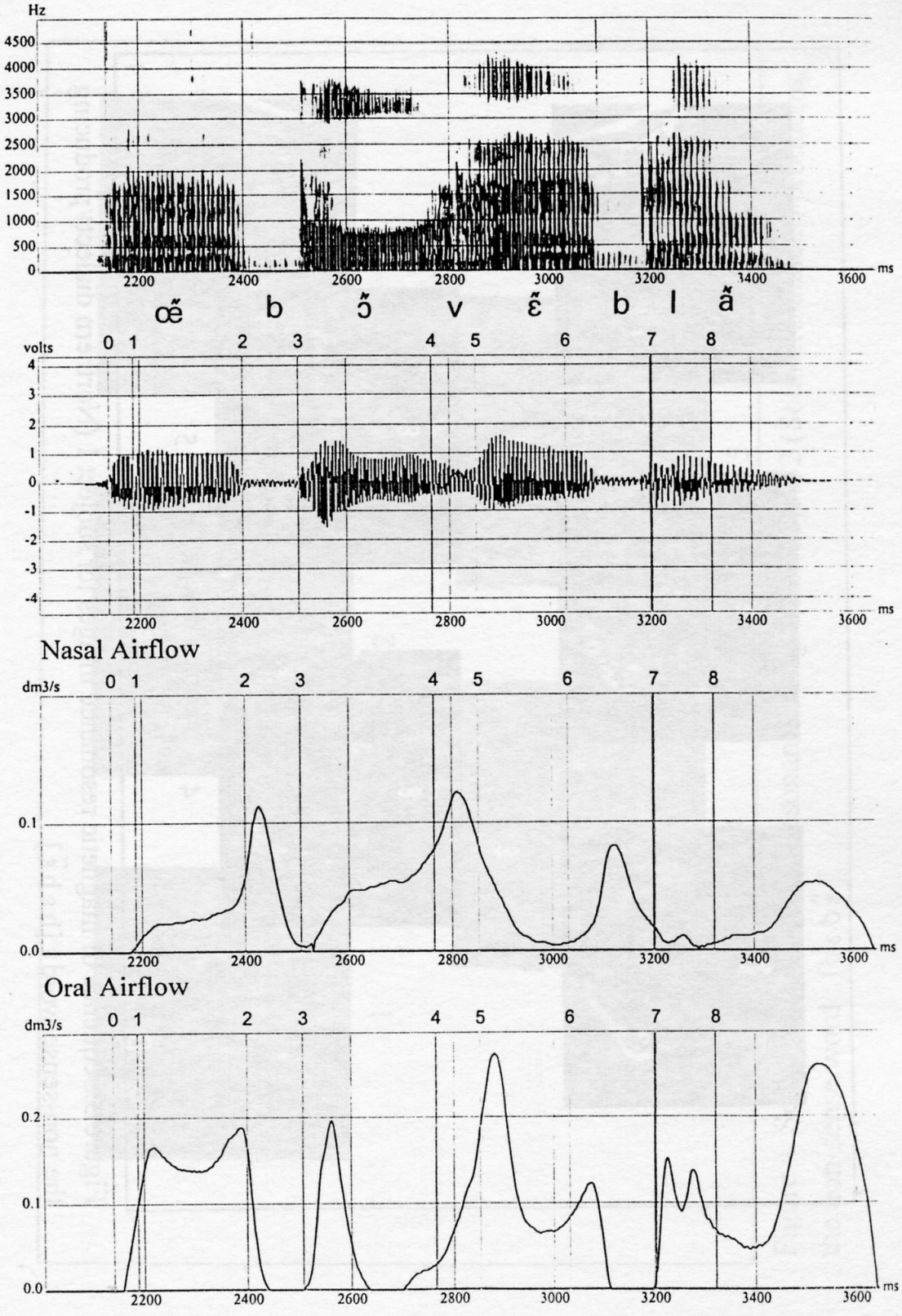

Figure 1: Sentence « Un bon vin blanc » produced by a Northern dialect speaker.

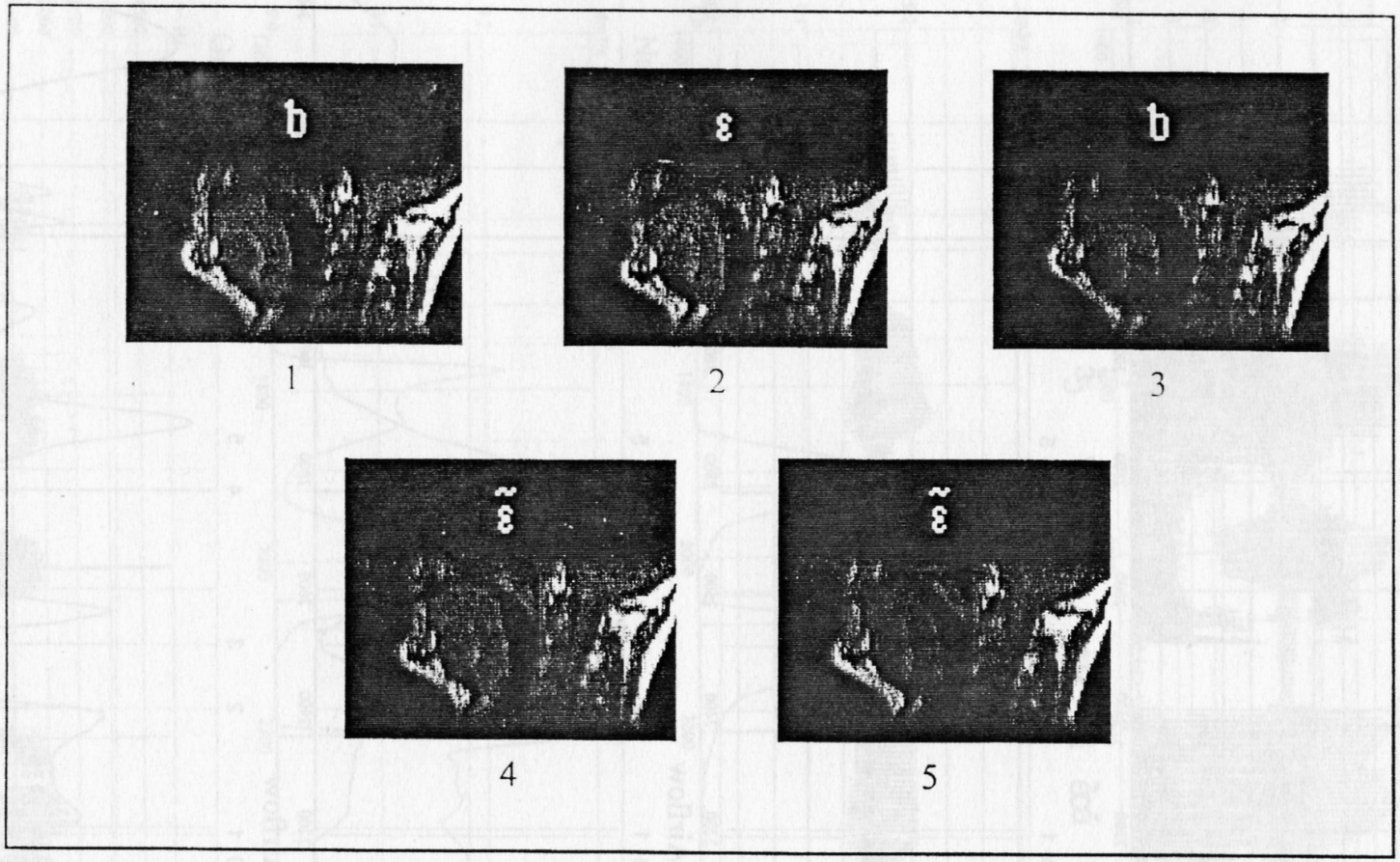

Figure 3.Sequence of magnetic resonance images for subject 1 (Northern dialect) producing the non-sense word : [ɒ ɛ ɒ ɛ̃].

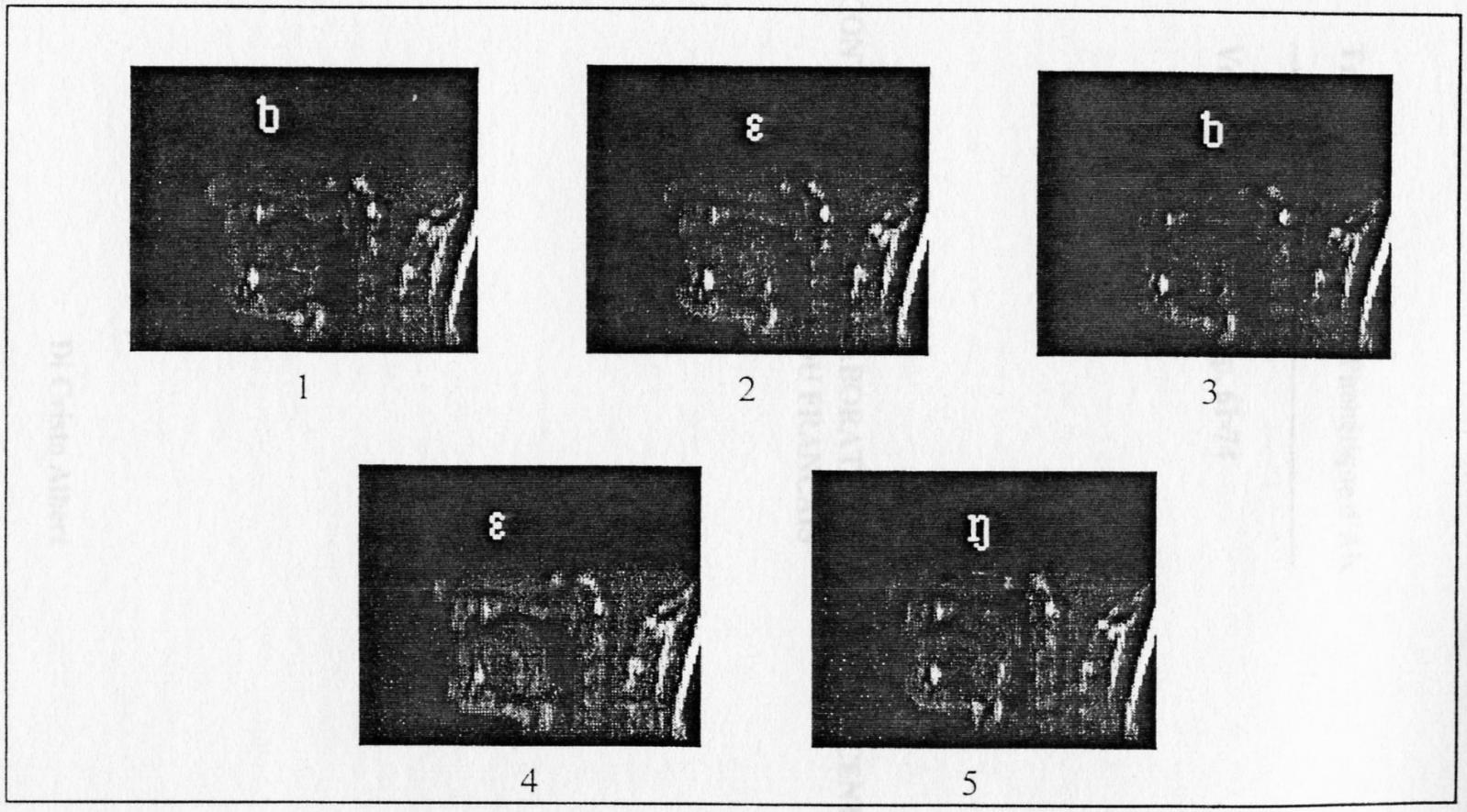

Figure 4. Sequence of magnetic resonance images for subject 2 (Southern dialect) producing the non-sense word : [ɒ ɛ ɒ ɛ̃].